DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA 750)
Migration of Contaminated Groundwater Under Control

RDMS DocID 108420

Facility Name: Vanderbilt Chemical Corporation (VCC)
Facility Address: 31 Taylor Avenue, Bethel, Connecticut 06801
Facility EPA ID #: CTD 001181205

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC), been **considered** in this EI determination?

X
——— If yes - check here and continue with #2 below.

——— If no - re-evaluate existing data, or

——— If data are not available, skip to #8 and enter "IN" (more information needed) status code

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("Ye" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, (GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated groundwater and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Is **groundwater** known or reasonably suspected to be **"contaminated"** [1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

X
——— If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

——— If no - skip to #8 and enter "Ye" status code, after citing appropriate "level," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

——— If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

The site groundwater is classified as GB by the Connecticut Department of Environmental Protection (CTDEP). The CTDEP Water Quality Standards defines GB groundwater as "assumed by the Department to be degraded due to a variety of pollution sources" and further states that "no specific groundwater quality criteria apply except those that may be promulgated as part of the Site Remediation Regulations required by Section 22a-133k of the General Statutes". The designated uses of GB groundwater include industrial process cooling waters and baseflow for hydraulically connected surface water bodies. GB groundwater is "presumed unfit for human consumption without treatment".

The only appropriate promulgated risk-based standards for the "protection of the groundwater and its beneficial uses" at the Vanderbilt site are the Surface Water Protection Criteria (SWPC) provided under the CT Remediation Standard Regulations (RSRs). The SWPC apply only to those wells nearest to the line of discharge to the receiving surface water body; however, alternative methods for evaluating compliance with the SWPC (e.g., plume averaging) are also provided under the RSRs. The other groundwater criteria provided under the RSRs – the Groundwater Protection Criteria (GWPC) and the Residential or Industrial Groundwater Volatilization Criteria (R/IGWVC) – and federal criteria under USEPA (e.g., the Maximum Contaminant Levels) are protective of human health but do not influence the evaluation of "stabilization" of contaminated groundwater. The GWPC apply only to Class GA groundwater. Potential exposures from groundwater volatilization were evaluated (and determined to be acceptable) for the EI-725 – Current Human Exposures Under Control.

Groundwater from the VCC site flows in a general westerly direction, mimicking the topography of the site and surrounding area, and discharges ultimately to the Sympaug Brook located west of the site. The site groundwater does not flow through any Class GA groundwater areas prior to discharging to Sympaug Brook. The investigations and discussions of site groundwater in previous reports have been divided into two "flow regimes" – the northern flow regime and the southern flow regime – due to the prominent bedrock ridge dividing the site groundwater flow into the two distinct flow regimes. For clarity, the discussions of the northern and southern flow regimes are presented separately to the extent practical.

Southern Flow Regime – Arsenic and (occasionally) selenium are the only constituents of concern (COCs) detected above applicable risk-based criteria (i.e., SWPC) that are protective of groundwater and its beneficial uses. The groundwater analytical data associated with the post-closure monitoring of the former RCRA surface impoundments in the southern flow regime is reported to USEPA and CTDEP quarterly.

Annual RCRA Groundwater Monitoring Reports are also prepared and submitted to both agencies. Quarterly monitoring data tables from the 2008 events are provided in Appendix A for reference.

Northern Flow Regime – Arsenic is the only COC routinely detected in groundwater at concentrations exceeding applicable risk-based criteria (i.e., the SWPC). Selenium concentrations also occasionally exceed the SWPC at one monitoring well cluster (the MW-11 cluster, which may be influenced by groundwater in the southern flow regime based on its location). Routine quarterly groundwater monitoring in the northern flow regime has been ongoing since 2005. Summary data tables presenting the 2008 groundwater quality data from the northern flow regime are also provided in Appendix A.

Additionally, as part of continuing RCRA Corrective Action activities, a screening level ecological risk assessment (SLERA) for the site was completed in early 2008 and submitted to CTDEP for review. Based on comments from CTDEP, a revised SLERA (Malcolm Pirnie, June 2009) was recently submitted to CTDEP. Relevant conclusions from the SLERA are presented in this determination, as appropriate.

Footnotes:

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater" [2] as defined by the monitoring locations designated at the time of this determination)?

X
——— If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination" [2].

——— If no - (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination" [2]) - skip to #8 and enter "NO" status code, after providing an explanation.

——— If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Southern Flow Regime – The groundwater monitoring program in the southern flow regime has evolved from initial "detection monitoring" in the mid 1980s, to "assessment monitoring" in 1988-89, to "post-closure monitoring" of the closed RCRA surface impoundments in 1996-97. Routine quarterly groundwater monitoring has been conducted since the mid 1980s. Based on the results of the initial detection monitoring, a Groundwater Assessment Plan (Malcolm Pirnie, 1991) was prepared and implemented, incorporating a total of 12 monitoring wells. Since 1993, these 12 wells located around the former surface impoundments have been monitored quarterly under RCRA. The monitoring well locations are shown on the attached Sheet 1. The groundwater data generated since 1993 has been maintained in a Microsoft ACCESS database.

The groundwater plume has been well defined over the course of the monitoring program. The plume is bounded to the east by upgradient well MW-8S and to the south by wells TW-1, and MW-1I. (Note that these southern boundary wells have been monitored quarterly since 2005; however, they were not included in the routine Groundwater Assessment or post-closure monitoring programs due to their distance from the surface impoundments and the relatively low COC concentrations). COC concentrations at these well locations are generally comparable to site background values in upgradient well MW-8S and thus define the lateral extent of the plume to the south. Data tables and COC concentration trend charts for these wells are provided in Appendix B. To the north, the plume merges with the northern flow regime plume, which is discussed below. The vertical extent of the plume is defined by the bedrock wells (MW-3D and MW-4D), which generally exhibit much lower COC concentrations than the overburden wells for the primary COCs.

Groundwater west and immediately downgradient of the closed impoundments is characterized by the MW-4 and MW-7 well clusters. The MW-4 well cluster consists of shallow well S-5, intermediate overburden well MW-4I, and bedrock well MW-4D. The MW-7 well cluster consists of shallow well MW-7S and intermediate overburden well MW-7I. Note that the western site boundary is located less than 150 feet west of the former impoundments; extensive wetlands of the Sympaug Brook watershed border the site to the west. The COC concentration trends at these downgradient boundary wells are stable, as shown in the trend charts provided in Appendix B. The trend charts present three years of monitoring data (2006-2008) for the detected COCs in accordance with RCRA post-closure monitoring guidance.

The former surface impoundments were formally closed and capped more than 10 years ago. Arsenic is the primary COC for the southern flow regime. Arsenic concentrations in the downgradient shallow wells (S-5 and MW-7S) and the downgradient intermediate wells (MW-4I and MW-7I) wells consistently exceed the stringent SWPC of 0.004 mg/l; however, as illustrated by the trend charts, the concentrations are generally stable or decreasing. Selenium concentrations in the downgradient boundary wells (where the SWPC apply) have also occasionally exceeded the SWPC of 0.05 mg/l. Despite periodic fluctuations in the downgradient COC concentrations due to seasonal variability, the groundwater plume in the southern flow regime has stabilized and thus is expected to remain within the area of existing contaminated groundwater.

Northern Flow Regime – The groundwater monitoring program in the northern flow regime has been performed intermittently over the past 18 years. Routine quarterly groundwater monitoring was re-initiated in 2005 and has been conducted for the past 3+ years. The monitoring well network includes 10 monitoring wells, as shown on Sheet 1. Two additional wells (MW-11S and MW-11I) were added in 2006 to supplement the data set between the northern and southern flow regimes. Well samples are analyzed for VOCs and metals (RCRA 8 + Cu, Ni, and Zn).

The groundwater quality in the northern flow regime has been well documented over this monitoring period, and the data are largely compliant with the applicable CT RSR groundwater criteria. Few, if any, VOCs are present in the northern flow regime groundwater, and there is no significant VOC plume in this portion of the site. The concentrations of metals are generally much lower than those in the southern flow regime. Arsenic is the only COC routinely detected above the SWPC in the downgradient boundary wells. The minor arsenic plume is also well defined and delineated by the existing well network. The plume is bounded to the north by the MW-19 well cluster, which generally exhibits COC concentrations comparable to background values. To the south, the plume merges with the southern flow regime.

Groundwater west and immediately downgradient of the remediated work areas is characterized by shallow wells S-6R, MW-17S, and MW-18S. Note that the western site boundary is located only a short distance west of these well locations. Railroad tracks, warehousing and other commercial facilities border this portion of the site to the west. Sympaug Brook is located about 1,000 feet west of the site boundary.

A chart of arsenic concentration trends in these wells is provided in Appendix B and indicates generally stable trends. The soil remediation in the work areas potentially affecting the northern flow regime groundwater has been substantially completed, so concentrations are expected to decrease over time due to the source removal. Despite periodic fluctuations in the downgradient COC concentrations due to seasonal variability, the minor groundwater plume in the northern flow regime has stabilized and thus is expected to remain within the area of existing contaminated groundwater.

[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e. including public participation) allowing a limited area for natural attenuation.

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

X
——— If yes - continue after identifying potentially affected surface water bodies.

——— If no - skip to #7 (and enter a "Ye" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

——— If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

The groundwater flow direction across the site is from east to west. Groundwater from the site discharges ultimately to Sympaug Brook west of the site boundary. In the southern flow regime, extensive wetlands are present between site boundary and Sympaug Brook.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and the number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

_____ If yes - skip to #7 (and enter "Ye" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level (s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco--system.

X
_____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter "IN" status code.

Rationale and Reference(s):

Southern Flow Regime

1)

Contaminant	Max. Conc.	Regulatory Criteria	Conc. Increasing?
Arsenic	0.28 mg/l (S-5)	0.004 mg/l	No
Selenium	0.066 (MW-4I)	0.05 mg/l	No

Northern Flow Regime

Contaminant	Max. Conc.	Regulatory Criteria	Conc. Increasing?
Arsenic	0.034 mg/l (S-6R)	0.004 mg/l	No
Selenium	0.069 (MW-11S)	0.05 mg/l	No

2) Not Applicable. All maximum concentrations are less than 100 times their appropriate "level(s)".

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments, or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented [4])?

X

_____ If yes - continue after either: identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment, [5] appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialist, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio/assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of "contaminated" groundwater can not be shown to be currently acceptable") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to # 8 and enter "IN" status code.

Rationale and Reference(s):

As summarized under Question #5, arsenic is the only COC known or reasonably suspected to be discharged above its appropriate groundwater "level" in both flow regimes. The maximum selenium values also slightly exceed their appropriate "level" – the SWPC. The SLERA indicates that arsenic is not a constituent of potential ecological concern (COPEC) for groundwater or surface water, as the maximum arsenic groundwater concentrations at the downgradient site boundary are below the ecotoxicity screening value (ESV). In addition, surface water samples collected in June 2006 indicate only a trace of arsenic (0.0025 mg/l) in one sample (SW-1) collected from Sympaug Brook a significant distance downstream of the site (> 2,000 feet away) where the brook crosses South Street. The detected concentration is just above the reporting limit and well below the ESV – the CT chronic Freshwater Aquatic Life Criteria (FALC) of 0.150 mg/l. Selenium is a COPEC for groundwater in both flow regimes based on the maximum detected concentrations in the boundary wells; however, the vast majority of selenium concentrations are below the SWPC, and the SLERA concludes that ecological risk due to selenium are negligible.

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g. nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that the discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater **monitoring** / measurement data (surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

X

——— If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

——— If no - enter "NO" status code in #8.

——— If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

Southern Flow Regime
Routine quarterly groundwater monitoring in the southern flow regime will continue under the post-closure RCRA monitoring program. As discussed, this program includes monitoring at several wells along the downgradient site boundary (i.e., the MW-4 and MW-7 well clusters). Wells TW-1 and well MW-11, which bound the lateral extent of the plume, as described under Question #3, will also continue to be monitored under the RCRA Corrective Action program. The bedrock wells will also be monitored to confirm the vertical extent of the plume.

Northern Flow Regime
The ongoing quarterly groundwater monitoring in the northern flow regime will continue through 2009 and likely through 2010 to evaluate compliance with the CT RSR groundwater criteria following completion of the soil remediation in 2009. This program also includes monitoring at several wells along the downgradient site boundary (i.e., well S-6R, well MW-17S, and the MW-19 well cluster). The MW-19 well cluster bounds the lateral extent of the plume in the northern flow regime, as described under Question #3.

8.. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

X

YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater " is "Under Control" at the

facility, EPA ID # CTD 001181205
located at 31 Taylor Avenue, Bethel, CT 06801

Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater." This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

NO - Unacceptable migration of contaminated groundwater is observed or expected.

IN - More information is needed to make a determination.

Completed by: (signature) _____ Date: 6/11/09
(print) Mark Barmasse, P.E., LEP, BCEE
(title) Senior Associate

Supervisor: (signature) _____ Date: 10/27/09
(print) EDGAR A. DAVIS
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